are occasionally seen, passing rapidly from the Helm over to the Bar, showing that a strong east wind prevails there. Above this open space, in the open stratum of clouds, one may often see a higher stratum which is evidently so high up that it is above the influence of the valley and the lower winds.

LUNAR RAINBOW.

A brilliant lunar rainbow was observed at Louisville, Ky., on February 27, between 8 and 10 p. m. As described by Weather Bureau Observer O'Connor a small circle appeared first, formed in the thin fibrous clouds that were moving from west to east. As these spread over the heavens a large circle of about 40° in diameter was observed encircling the zenith at 8:20 p. m. As the moon descended in the west this circumzenithal circle increased in diameter until at 9:10 p. m. it was about 60° in diameter, after which it began to fade away in the east, and by 9:50 had entirely disappeared. The circle about the moon itself at no time exceeded 6° in diameter. When first formed it appeared to be a true circle, but as the moon approached the horizon it became oblong and finally, before disappearing, had dwindled into a mere line, passing vertically through the moon at about 10 p. m. In the earlier stages the circle around the zenith had a greenish tint.

WATERSPOUT.

According to an extract from the San Francisco Call, the British bark *Fairfield*, of Glasgow, encountered on her trip between Shanghai and Tacoma a waterspout and hurricane that stripped her bare of canvas. The *Fairfield* passed within a quarter of a mile of this waterspout when about a week out from Shanghai, viz, on February 10. The sky became suddenly overcast and soon an electric storm was raging. The sky darkened and the wind came in puffs of hurricane violence. An attempt was made to turn the ship northward but it was too late to escape the storm. In a very few minutes an immense black funnel cloud went swirling by, striking terror into every one aboard. There was an awful roar and the water seemed to be sucked from the ocean up to a height of 300 feet. Had the *Fairfield* been in the path of the waterspout she might have been destroyed in a twinkling. An hour after the waterspout passed the sun was shining and the ship was sailing through a peaceful sea as though nothing had happened. The vessel was in the most violent part of the storm for about forty minutes.

PHOTOGRAPHS OF METEOROLOGICAL PHENOMENA.

The Weather Bureau has received from Mr. S. B. Strong, voluntary observer at Setauket, N. Y., a small photograph of the parhelia observed at that place on February 2, 1898, at 4:50 p. m. It is very interesting to find that not only the mock sun, but even the vertical and horizontal bands of light and a portion of the circular halos can be traced on this picture, and Mr. Strong's success in this work leads us to encourage other amateur photographers to attempt to preserve similar beautiful optical phenomena that are especially frequent at our western stations. But, in order to make these photographs of any use in the investigation of the halo phenomena, it will be necessary for the observer to devise some way by which to secure on this same plate some means of making accurate observations of the apparent angular distances. For instance, the present photograph shows the mock sun located about an inch and three-quarters to the right of the real sun. If we knew that the camera was pointed midway between the two, and that the focal length of the lens was about three inches, then we might figure out that the apparent angular bearing of the mock sun was about 30° to the right of the true sun. The photograph also shows both these suns elevated about one-third of an inch above the hills in the distant horizon, which we may figure out to be equivalent to an apparent angular altitude of about 10°. But what the meteorologist wants is the angular altitude above the true horizon below these hills, and the angular distance between the true sun and the mock sun; in fact, all the measurements relating to halos and parhelic circles must be given in angles. An ordinary photograph is merely a good witness to the fact that a halo occurred; it must be accompanied by some basis for angular measurements before it can be of any further use to the meteorologist. A common method of accomplishing this object consists in placing in front of the camera a framework of wires stretched at right angles to each other and so placed that one set is strictly horizontal and the other vertical. The intersection of the middle wires on the frame should be directly in front of the camera, and be photographed in the middle of the plate when the axis of the camera is exactly horizontal, as determined by a spirit level or plumb line. If we know the distance of the center of the wire frame from the optical center of the lens, we can easily calculate by trigonometry the angle subtended by the respective wires. If now, in this position, a photograph of the framework is taken on one of the plates that just fits into the plate holder, we find the latter covered by the pictures of the wires intersecting each other in a network. In general, the images of the wires will not appear straight but slightly curved, depending upon the lens that is used. Nevertheless, we know that every point along any one of the horizontal wires is at a known distance above or below the center of the plate and every point on any one of the vertical wires is at a known angular distance to the right or left of the center. Such a plate as this negative can now be preserved for future use. Whenever a landscape is photographed and measurements are desired the negative containing this network of lines is laid upon the landscape negative and a print of the two combined is taken, on which measurements of angular distances can be made with ease.

When this method is to be applied to clouds or other objects where the axis of the camera must be tilted upward, it is convenient to attach the camera, as a whole, to some altitude and azimuth instrument. If this is done with great accuracy it constitutes the apparatus known as "the photogrammeter" which has been much used during the past few years in the international cloud work. This apparatus becomes rather expensive when well made, but is universally applicable to photography of clouds, halo phenomena, waterspouts and tornado clouds, meteors or shooting stars, flying birds, kite work, and to sketches—we regret not to be able to say photographs—of the aurora borealis and the zodiacal light. It is evident, therefore, that our voluntary observers who possess cameras will contribute to exact meteorology in proportion as they obtain the additional equipment needed to attain accurate angular measurements.

GREENWICH NOON.

A voluntary observer, referring to a paragraph in the MONTHLY WEATHER REVIEW for August, 1897, and which has been repeated in the introduction to succeeding REVIEWS, inquires: "When it is 12 o'clock noon at Greenwich, is it then exactly 7 o'clock a. m. at stations 75° west of Greenwich?" To this question we answer, "Yes." Every 15° of longitude corresponds to one hour of time. The earth rotates on its axis—that is to say, any point describes a small circle of latitude around the earth's axis, or 360° in twenty-four hours, or at the rate of 15° per hour. When the Greenwich meridian passes through the sun, that is to say, when it is "mean noon" at Greenwich, then a station like Philadelphia, 75° west of Greenwich, is still five hours distant from the sun, and has